Determinations of multipolarities of low-energy transitions and measurements of level half-lives in neutron-rich $^{110, 112}$Rh

Y.X. Luo, J.O. Rasmussen, J.H. Hamilton, A.V. Ramayya, J.K.Hwang, S.J. Zhu, P. M. Gore, S.C. Wu, I.Y. Lee, C.M. Folden III, P. Zielinski, A.O. Macchiavelli, M.A. Stoyer, R. Donangelo, S.J. Asztalos, and A. Gelberg

New level schemes of $^{110, 112}$Rh are proposed by using ^{252}Cf fission triple-coincidence data from Gammasphere taken in 1995 and 2000 [1]. Low-lying transitions with low transition energies are observed for the first time at the bottom of the negative-parity bands (see figure 1). No decay data of $^{110, 112}$Rh are available so far for the spin/parity assignments of the low-lying levels on which these negative parity bands are built.

We determine the total internal conversion coefficients of low-energy transitions based on the intensity balance of two cascading transitions in spectra gated from the feeding transitions above. In a downward cascade consisting of γ_4, γ_3, γ_2 and γ_1, by gating at the transitions γ_3 and γ_4, we have

$$I_1 \times (1+\alpha_1) = I_2 \times (1+\alpha_2) \qquad (1)$$

where I and α indicates the phonon transition intensity and total internal conversion coefficient, and the subscript 1 and 2 represents γ_1 and γ_2, respectively. If α_1 (or α_2) is known or can be deduced, α_2 (or α_1) is given by Equation (1) by measuring the phonon intensities I in the gated spectrum. Gating on 186.8- and 299.9-keV transitions in ^{110}Rh, the intensity balance of 58.9 and 159.3 keV transitions (and also the decay pattern) only supports the following assignments: 58.9 keV transition as E1 and 159.3 keV as M1 (+E2). Then gating on the 186.8 and 159.3 keV transitions and inserting into Equation (1) the theoretical ICC value of α(58.9 keV, E1), we determine α(65.8 keV), and, with comparison to theoretical values, M1+E2 is assigned to the 65.8 keV transition. Based on the α(65.8 keV, M1+E2) obtained, α(159.3 keV, M1+E2) is determined in the same way, and so is the 186.8 keV transition with gating higher at the 299.9 and 258.0 keV transitions. All the results for $^{110, 112}$Rh are shown in the level schemes.

Hwang et al. of our collaboration developed a triple-γ-coincidence-timing method to measure the half lives of isomeric states populated in SF [2]. This method was applied to determine the half-life of the 58.9 keV, 6^- level of ^{110}Rh (see the figure for results).

1. Y.X. Luo *et al.*, to be published
2. J.K. Hwang *et al.*, to be published